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ACTIVITIES OF THE STRONG MOTION INSTRUMENTATION PROGRAM

August 3, 1977 to September 15, 1978

OFFICE OF STRONG MOTION STUDIES
DIVISION OF MINES AND GEOLOGY
DEPARTMENT OF CONSERVATION
STATE OF CALIFORNIA

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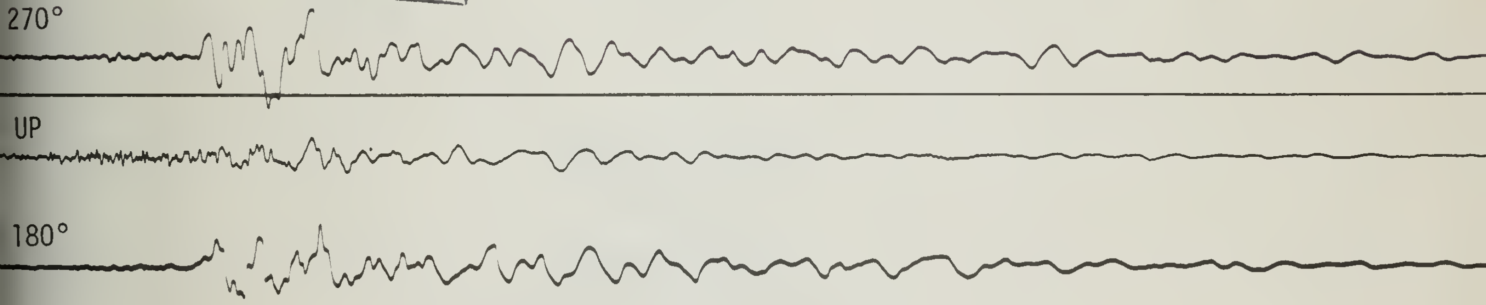

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CTIVITIES OF THE STRONG MOTION INSTRUMENTATION PROGRAM

August 3, 1977 to September 15, 1978

Thomas M. Wootton
Chief, OSMS

1979

OFFICE OF STRONG MOTION STUDIES
CALIFORNIA DIVISION OF MINES AND GEOLOGY
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ACTIVITIES OF THE STRONG MOTION INSTRUMENTATION PROGRAM

Office of Strong Motion Studies
Division of Mines and Geology
Department of Conservation

August 3, 1977 to September 15, 1978

GENERAL

This report is the first in a series of reports subsequently to be issued on an annual basis for periods coinciding with the State fiscal year of July 1 through June 30. This report covers the period between two meetings of the Strong Motion Instrumentation Committee of the Seismic Safety Commission on August 3, 1977 and September 15, 1978. Prior to August 3, 1977, an informal procedure of oral reporting presentation to the Committee was followed. However, the State Strong Motion Instrumentation Program has reached a size and complexity such that informal reporting of operational status and progress is no longer adequate, and a formal, regular periodic report such as this is necessary.

MISSION AND BROAD OBJECTIVES

Recent earthquakes, in particular the February 9, 1971 San Fernando earthquake, have demonstrated a need by the structural engineering community for additional data on response of structures and foundation materials to earthquake shaking in order to advance the technology of earthquake resistant design. Additonally, increasingly intensive investigations into earthquake mechanics by the seismological community have resulted in a need for data on ground response to earthquake shaking and on earthquake energy propagation effects.

It is the mission and objective of the Strong Motion Instrumentation Program to instrument representative structures and geologic settings throughout the State to maximize the probability of the collection of significant engineering and seismological data, and to process the data to usable form for dissemination to the user community for application to improved earthquake resistant structure design and enhancement of the public safety.

STATUTORY AUTHORIZATION

The Strong Motion Instrumentation Program is operated by the Division of Mines and Geology with the advice of the Seismic Safety Commission under the authorities set forth in Chapter 8 of Division 2, Sections 2700 through 2709 of the Public Resources Code, which are summarized as follows:

Sec. 2700	Establishes the Program
Sec. 2701	Assigns advisory function to the Seismic Safety Commission
Sec. 2702	Specifies the functions as purchasing, installing and maintaining instruments and processing records.
Sec. 2703	Specifies alternate means of carrying out functions.
2704	Specifies the intent of the Legislature to provide adequate instrumentation.

Sec. 2705	Sets the fee to be collected at .007 percent of estimated cost of construction.
Sec. 2706	Establishes the Strong-Motion Instrumentation Special Fund, and provides for continuous appropriation to the Division.
Sec. 2707	Provides for reduction of the fee when an adequate program has been achieved, as advised by the Seismic Safety Commission.
Sec. 2708	Provides conditions for exemption of cities and counties from the Program.
Sec. 2709	Provides for recision of exemption of cities and counties.

PROGRAM ACTIVITIES

OPERATIONS

Installations

During the report period, seven permanent free-field stations with a total of twenty-one data channels were added to the network. Of these, one station was taken over from the California Department of Water Resources and reinstrumented under this program, and two stations were taken over from the U.S. Geological Survey, Seismic Engineering Branch. An additional ten instruments, with a total of thirty data channels, were deployed to temporary installations in response to four seismic events at South Lake Tahoe, Ukiah, Shasta and Santa Barbara.

Rework and up-grade of free-field stations consisted of replacement of a "dome installation at Cape Mendocino with a "T-Hut" installation. As a point of interest, the dome installation was temporarily left in operation so that a data comparison between the two installation types could be made after the nex local seismic event.

Seven building systems representing a total of one hundred and five data channels were added to the network during this period, in El Centro, Irvine, Piedmont, Los Angeles, Oakland, Ventura and San Rafael.

Rework and up-grade of building systems consisted of increasing the size of the system in the Imperial County Services Building from nine to thirteen data channels. Review of building system performance disclosed a need for widespread correction in instrumentation deficiencies, primarily the nearly universal occurrence of inadequate solder connections by the vendor, and a nee to recalibrate many systems. The urgency of this rework was such that it was given priority over new installations with the result that program expansion was temporarily delayed.

Three dam instrument systems, two of which were complete reinstrumentations, consisting of a total of fifty-one data channels, were added to the network. The major effort in dam instrumentation was directed to rework and reinstrumer tation of Pacoima Dam, near San Fernando, and Lower Crystal Springs Dam near San Mateo. These two systems were expanded from nine data channels each, to twenty-one and fifteen, respectively, with advice and guidance of Professor Ray Clough of UCB, and the USGS Seismic Engineering Branch. In addition to this system expansion, seven dams received temporary corrective action by resolving problems which have caused complete system outage. The temporary action consisted of separating the dam instruments by removal of interconnecting cabling. Rework of these systems to restore full instrument capability will receive high priority.

The instrumentation of transportation facilities, which was initiated just prior to this reporting period,with one bridge system consisting of twelve data channels was expanded to include two additional bridges with a total of forty-six data channels.

Program status as of September 15, 1978 is summarized in the table below:

Installations prior to August 3, 1977

Type	Number	Data channels
Ground Motion, surface	239	717
Ground Motion, downhole	2	18
Buildings	29	278
Dams	14	144
Transportation facilities	1	12
Totals	284	1,151

Installations, August 3, 1977 to September 15, 1978

Type	Number	Data channels
Ground motion, surface	7	21
Ground motion, downhole	0	0
Buildings	7	103
Dams*	3*	51*
Transportation facilities	2	46
Totals	19	221

*Includes rework of two dams previously instrumented, with a net gain of 18 data channels.

Within the transportation facility instrumentation element of the program, the Division of Mines and Geology, through the Department of Conservation, has entered into a cooperative agreement with the U.S. Department of Transportation to instrument the Caldecott Tunnel. This tunnel instrumentation is to be a nineteen channel digital recording system with thirteen data channels recording tunnel response and six free-field channels of which three are to be placed in the subsurface at tunnel grade. Work on this project was started in July, 1978 and is scheduled for completion in August, 1979. The cost is being shared, with the U.S. Department of Transportation assuming the equipment costs and operating expenses, and the State is paying project costs of salaries and wages. The cost to the federal government is $48,000 and the cost to the State is estimated at $16,000.

The holding of a desired rate of from sixteen to twenty building and structure installations per year had been hampered by two factors. The first is the urgent need for corrective actions necessitated by advances in the state-of-the-art and discovery of some deficiencies in early installations.

Secondly, increasing knowledge of instrument system design has resulted in more complex installation which has overstressed the present installation staff. Both factors will be relieved by a staff increase in fiscal year 1979-80.

Service and Repair

The service and repair function is carried out by three technicians, one located at each of three offices. Experience has shown that the effective maximum service load is 100 to 125 instruments per technician, the exact load level depending primarily on instrument station density. At present, the State is divided into three areas, North, Central and South, with each area containing approximately the same number of instrument stations. The technicians operate from offices located within their respective areas (Sacramento, Bakersfield, and San Bernardino, respectively) in a nearly independent manner, with logistic support provided by the Sacramento base headquarters office.

Supervision over the service technicians is provided by the Service and Instrumentation Manager in Sacramento. Control is exercised through station service assignment, service scheduling and field check for compliance with service standards.

Present practice calls for tri-yearly (4 month) service cycle. However, as modifications to instrument systems are developed and servicing techniques improve, instrument operational reliability is expected to reach a level at which service intervals of six months will be adequate. This extended service period will allow an increase in technician/instrument service assignment without an increase in overall workload or loss in effectiveness.

Geologic Investigations

The function of the Geologic Investigations Section is primarily that of selecting free-field sites to meet predetermined geologic criteria, and determination of the areal geologic conditions at all sites. One important procedure in performance of this function is the conduct of shallow (< 30m. depth) refractive shear wave velocity surveys. This section also provides geologic input into reports and data storage systems.

Record Collection

The end product of the operational phase of the Program is the collection of strong-motion records resulting from earthquakes. The records collected und the Program are divided into two categories. Sixty-three records were colle ed prior to the assumption of record archiving by the Division of Mines and Geology in January, 1977 and delivered to the U.S. Geological Survey for processing and archiving, and 106 records were collected during the period January 1, 1977 to September 15, 1978 which are archived by the Program in Sacramento. A brief summary of records with more than 2% g peak amplitudes station and event date are listed in the table Attachment A.

DATA MANAGEMENT

The Data Management function is divided into two distinct parts: data processing and data dissemination. The first part must be developed to some point before the second part can become operational. Initial steps to develop a data processing capability were taken immediately after the authority and mandate to do so were provided by the adoption of Chapter 1243, Statutes of 1976, on January 1, 1977.

Completion of a comprehensive feasibility study report was required for approval by the State Department of Finance before any significant funds could be spent for any data processing activities. The feasibility study report (FSR) is a departmental report and, is to be prepared by the Department of Conservation with technical support from the Division. Work was started by Strong Motion Program personnel pending the addition of departmental staff to prepare the report. Collection and collation of background and technical data were carried out by Program personnel prior to and through the start of this report period. It was estimated at the outset of this report period (August 1977) that a suitable FSR could be prepared relatively quickly, but this optimism was short-lived. In pursuing the required study, we learned that the State Data Processing Management Office, in the Department of Finance, requires a very complete and rigorous feasibility study before they will approve significant EDP expenditures. A more sophisticated report is required than the Division had previously recognized. In July 1978, an EDP Programmer/Analyst was added to the Department of Conservation staff to work with DMG staff to produce the needed FSR in the required format and degree of detail and to assist in EDP applications for other Division projects.

Although the FSR project was given high priority, other work, including processing of the 21 SMIP data traces obtained from the Santa Barbara earthquake of August 13, had to be done, which delayed the FSR. Assuming that no significant earthquakes occur requiring records processing by Program staff in the next two months, it can be expected that Department and Program staff assigned to the project will work full-time to complete the FSR. Barring significant snags in the process, they will complete it for submission to the Department of Finance for approval by the end of February, 1979. After Finance approval of the FSR, implementation of the work-plan to establish the EDP system spelled out in the FSR will begin. This means hiring specialized personnel in spite of possible continuation of the present State personnel hiring freeze, acquiring and modifying software, acquiring hardware, and taking other related actions.

In view of the need for at least a minimal record processing capability, an interim data processing operation, utilizing minimal funding taken from other Strong Motion Program activities, has been developed at the Lawrence Berkeley Laboratory under contract with the U.S. Department of Energy and utilizing U.S.G.S. codes.

The August 13, 1978 Santa Barbara earthquake produced a test of the interim data processing and dissemination function of the Program. A variety of conflicting requests and demands resulted in conflicting priorities between data processing and data dissemination, a problem that will be resolved upon approval and implementation of a Budget

Change Proposal, now before the Department of Finance, which provides for two additional staff members in Data Management. Initial requests for information were met by release of copies of annotated records to specific requesters. Work was begun immediately on the digitizing of analog records and processing of the data and on the preparation of a preliminary report. However, under the manpower and funding constraints experienced by the Program, pending completion and approval of the FSR, completion of the data report is not expected until October with general distribution to start in November, 1978. Greater delays are expected in completing the data processing.

PROGRAM PLANNING

Planning for the ground response, buildings, transportation facilities, dams, and lifeline elements of the program are carried out with the advice and assistance of the Strong Motion Instrumentation Committee of the Seismic Safety Commission. The committee's subcommittees guide the planning,advise on the selection of individual sites and facilities, and provide assistance in designing instrumentation systems.

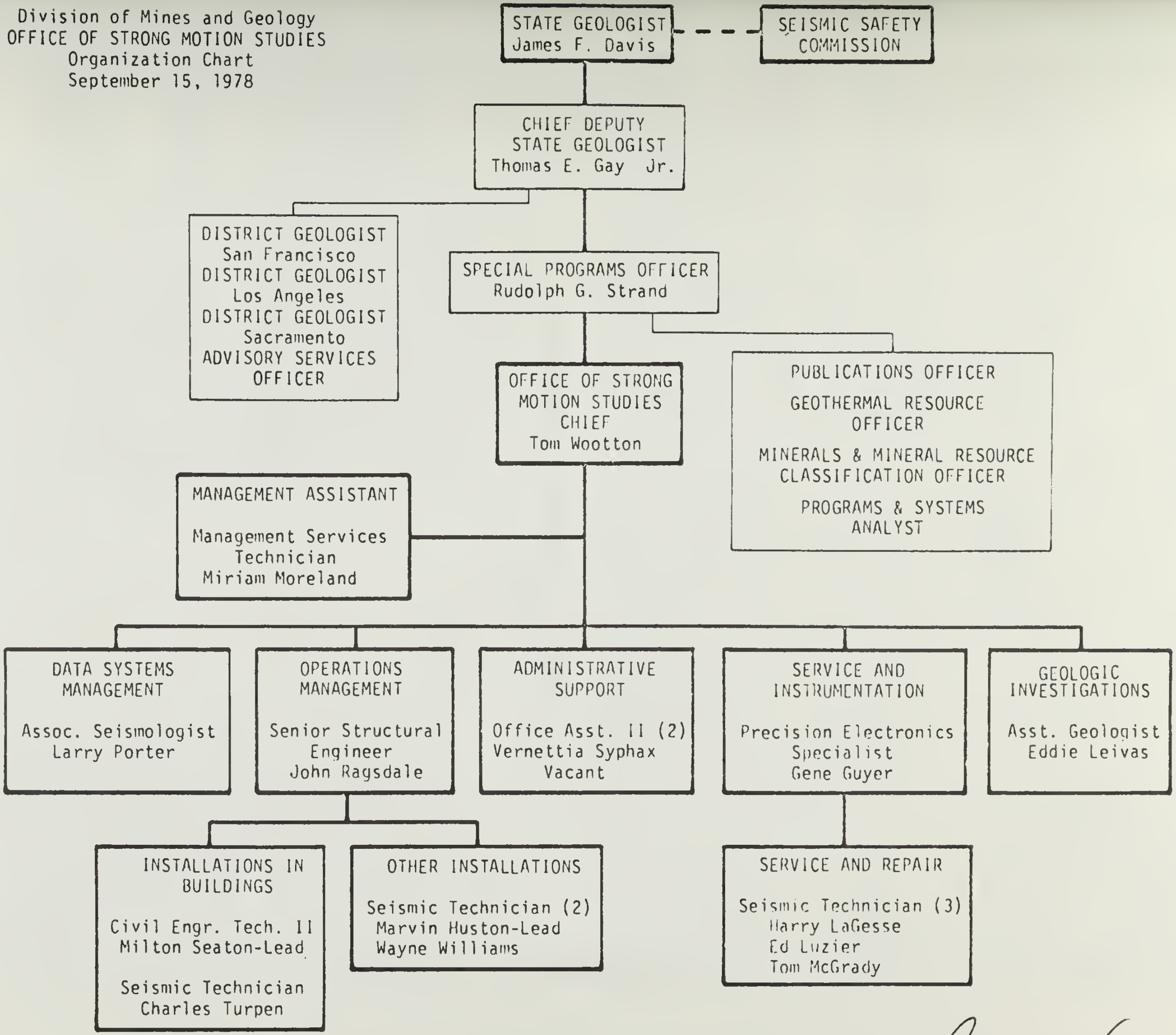
The Strong Motion Instrumentation Advisory Board, predecessor to the Strong Motion Instrumentation Committee determined that an adequate level of instrumentation for the State should ultimately include approximately 500 ground response installations, 400 buildings, 50 transportation facilities, 30 dams, and 50 various lifeline facilities. A variety of organizations and agencies have participated in the selection of sites and structures for instrumentation. Representatives of the Structural Engineers Association of California working with a subcommittee of the Advisory Committee have prepared an initial list of 54 buildings as candidates for instrumentation and are now preparing an additional list. Representatives of California Department of Transportation and other transportation organizations provided a list of 49 transportation facilities. The Division of Dam Safety has nominated 30 dams, and the California Water and Power Earthquake Engineering Forum has provided a priority list of 17 lifeline facilities such as power plants, water treatment plants and water transmission and storage structures.

The ground motion instrumentation phase of the Program has been developed to provide for deployment of instruments throughout the State adequate to capture data from any magnitude 6 earthquake. With the advice and assistance of the Committee, emphasis can now be shifted to the design and deployment of linear, areal and vertical arrays.

ADMINISTRATION AND ORGANIZATION

The Division of Mines and Geology operates the State Strong Motion Instrumentation Program through its Office of Strong Motion Studies. Under an organizational scheme proposed by the present State Geologist, the Program Manager reports directly to the Special Programs Officer, Division Headquarters Staff.

Division of Mines and Geology
OFFICE OF STRONG MOTION STUDIES
Organization Chart
September 15, 1978



Proposed by: Tom M. Wootton
Tom M. Wootton
Chief, Office of Strong Motion Studies

Approved: James F. Davis
James F. Davis
State Geologist

The addition to staff of a structural engineer and two technicians has enabled the Office of Strong Motion Studies to adopt the organization depicted above.

Minor changes in the proposed organization of the Office as depicted on the chart include the addition of a management assistant and a division of the supervision over field technicians between the Operations Manager and the Service and Instrumentation Manager. The addition of the Management Assistant is made necessary by the fact that the Office of Strong Motion Studies is funded separately from the rest of the Division and has therefore been assigned administrative functions parallel to but at a smaller scale to those of the Division. The separation of supervision over service technicians from Operations Management was an operational decision to improve consistency of control.

Advice is provided to the Division by the Seismic Safety Commission through its Strong Motion Instrumentation Committee, which is chaired by a Commissioner and whose membership is made up of a group of strong-motion experts and other highly interested individuals.

The major continuing contribution by the Committee is advice and assistance in the selection of, and instrumentation system design for ground response sites, building, dams, transportation facilities and lifeline facilities. The Committee also provides valuable guidance in such matters as data processing and dissemination, allocation of resources, public relations, and in general policy development. Membership of the Strong Motion Instrumentation Committee and its subcommittees is given in the following table:

STRONG MOTION INSTRUMENTATION COMMITTEE

Name	Representing
Dr. H. Bolton Seed, Chairman	Seismic Safety Commission
Mr. John Canestro	League of California Cities
Mr. Robert C. Cassano	California Dept. of Transportation
Mr. LeRoy L. Crandall	Structural Engineers Association
Ms. Mary W. Henderson	Public
Professor Paul C. Jennings	California Institute of Technology
Mr. John F. Meehan	Office of the State Architect
Mr. L. Dale Mills	County Supervisors Assoc. of Calif.
Dr. Gordon B. Oakeshott	Public
Mr. Wilferd W. Peak	Dept. of Water Resources
Mr. John O. Robb	Structural Engineers Association
Mr. Christopher Rojahn	U. S. Geological Survey
Mr. William M. Wells	Public
Mr. Tom M. Wootton	Division of Mines and Geology
Mr. David J. Leeds	Earthquake Engineering Research Inst.
Professor Ta-Liang Teng	University of Southern California
Dr. R.B. Matthiesen	U. S. Geological Survey

SUBCOMMITTEES

Ground Motion

Dr. R.B. Matthiesen, Chairman
Prof. Ta-Liang Teng
Mr. Tom M. Wootton
Dr. Lawrence D. Porter

Buildings and Structures

Mr. Christopher Rojahn, Chairman
Mr. John O. Robb
Mr. John F. Meehan
Mr. John T. Ragsdale
Mr. Roland L. Sharpe
Mr. Chris D. Poland
Mr. Kenneth K. Honda
Prof. Gary C. Hart

Dams, Water and Power Facilities

Mr. Wilferd W. Peak, Chairman
Mr. LeRoy L. Crandall
Mr. Christopher Rojahn
Mr. David J. Leeds
Mr. Tom M. Wootton

Transportation and Other Lifeline Facilities

Mr. Robert C. Cassano, Chairman
Mr. L. Dale Mills
Mr. John Canestro
Ms. Mary W. Henderson
Mr. Tom M. Wootton

Allocation of Resources

Dr. Gordon B. Oakeshott, Chairman
Dr. R.B. Matthiesen
Mr. Tom M. Wootton

Public Relations

Mr. John Canestro, Chairman
Ms. Mary W. Henderson

Data Management

Prof. Paul C. Jennings, Chairman
Dr. R.B. Matthiesen
Dr. Lawrence D. Porter

PERSONNEL

PERMANENT PROGRAM STAFF MEMBERS AS OF 15 SEPTEMBER 1978

EMPLOYEE	CLASSIFICATION AND FUNCTION
Tom M. Wootton	Senior Geologist, Chief, Office of Strong Motion Studies
John T. Ragsdale	Senior Structural Engineer, Operations Manager
Lawrence D. Porter	Associate Seismologist, Data System Manager
Eddie M. Leivas	Assistant Geologist, Geologic Investigations Manager
Albert G. Guyer	Precision Instrument Technician, Service and Instrumentation Manager
Miriam E. Moreland	Management Services Technician, (T&D) Management Assistant
Milton J. Seaton	Civil Engineering Technician II, Building Installation Leadman
Marvin M. Huston	Electronics Technician, Other Installations Leadman
Harry LaGesse	Electronics Technician, Service and Repair (San Bernardino Office)
Charles E. Luzier	Electronics Technician, Service and Repair
Thomas McGrady, Jr.	Electronics Technician, Service and Repair (Bakersfield Office)
Charles D. Turpen	Electronics Technician, Building Installations
Wayne W. Williams	Electronics Technician, Other Installations
Vernettia G. Syphax	Office Assistant II, Secretary
(Vacant Position)	Office Assistant II, Fiscal Clerk

OFFICES

HEADQUARTERS

The Program headquarters is located at 2811 "O" Street, Sacramento, California. It houses the entire management and administrative staff, the two installation teams, the north state area service technician and the main shop.

FIELD OFFICES

Two field offices have been established to promote efficiency for the service and repair functions. The technician charged with the service function in the central area of the State maintains an office at 4800 Stockdale Boulevard, Bakersfield, and the technician for Southern California is housed at 303 West 3rd Street, San Bernardino.

BUDGET AND FUND SUMMARY

An increase in budgeted expenditures appropriated from the Special Fund from $553,605 in fiscal year July 1, 1976 to June 30, 1977 to $667,450 in fiscal year July 1, 1977 to June 30, 1978, covered inflationary increases and three additions in staffing necessitated by Program growth.

The fiscal year 1977-78 expenditures by budgetary allocation are summarized below:

Salaries and wages		$269,874
Operating expenses		166,586
General expense	$78,817	
Printing	549	
Communication	6,422	
Travel	30,916	
Vehicle operation	19,585	
Contracted services	6,726	
Administrative charges	5,095	
Rent	16,950	
Training	526	
Data Processing	1,000	
Equipment		200,581
Total expenditures		$637,041
Administrative costs to Department		30,409
TOTAL COSTS		$667,450

The Strong Motion Instrumentation Special Fund status is as follows:

Balance on July 1, 1977	$ 563,640
Revenue, 1977-78	914,132
Available funds, 1977-78	1,477,772
Expenditures 1977-78	667,450
Balance on July 1, 1978	$ 810,322

Although effects of the passage of Proposition 13 were not felt in the fiscal year ending on June 30, 1978, a cut in the appropriation form the Fund for equipment of $12,000 was experienced in July 1, 1978, in response to the Proposition. Cuts in appropriations for the year starting July 1, 1979, are not yet defined but are expected to be in excess of $70,000. It should be noted that the cuts in Program funding are simply returned to the Strong Motion Instrumentation Special Fund and are reflected as increases to the present Fund balance, which is presently more than adequate to implement a data processing capability.

Respectfully submitted,

Tom M. Wootton

TOM M. WOOTTON, Chief
Office of Strong Motion Studies

ATTACHMENT A

Strong motion accelerograph records with a peak amplitude of 2% g or greater collected under the California Strong Motion Instrumentation Program.

Records archived by U.S.G.S.

Station Name	Date	No. of Channels	Peak Accel.(g)
Lake Berryessa	9/16/73	3	0.18
Gilroy	1/10/74	3	0.09
Gilroy	1/31/74	3	0.16
L. A. Bunker Hill	4/1-7/16/74		0.09
Gilroy	4/17/74	3	0.06
Kagel Canyon	8/14/74	3	0.06
Vasquez Rocks	8/14/74	3	0.10
San Juan Bautista	11/28/74	3	0.12
Gilroy	11/28/74	3	0.14
Parkfield Grade	1/6/75	3	0.08
Vineyard Canyon	1/6/75	3	0.09
Petrolia	1/11/75	3	0.19
Cape Mendocino	1/11/75	3	0.10
Shelter Cove #1	5/6/75	3	0.06
Shelter Cove #2	5/6/75	3	0.18
Mount Able	5/12/75	3	0.07
Cape Mendocino	6/7/75	3	0.22
Petrolia	6/7/75	3	0.19
Shelter Cove # 2	6/7/75	3	0.10
El Centro # 6	6/19/75	3	0.10
El Centro # 6	6/20/75	3	0.13
Chico	8/1/75	3	0.08
Marysville	8/1/75	3	0.07
Palm Springs	8/1/75	3	0.05
Puerta LaCruz	8/1/75	3	0.08
Sage	8/1/75	3	0.06
Mariposa	8/2-8/19/75	3	0.08
Parkfield	9/13/75	3	0.07
Parkfield Grade	9/13/75	3	0.14
Vineyard Canyon	9/13/75	3	0.29
Cape Mendocino	11/14/75	3	0.13
Petrolia	11/14/75	3	0.10
Shelter Cove # 2	11/14/75	3	0.07
El Centro #6	4/14/76	3	0.14
Niland	11/4/76	3	0.08

Archived by CSMIP

Station Name	Date	No. of Channels	Peak Accel.(g)
Cape Mendocino	9/14/76	3	0.05
Grubbs Ranch	10/24/76	3	0.03
El Cerrito, Capwells	1/6/77	6	0.05
Johnson Ranch	1/9/77	3	0.06
Nelson Ranch	1/9/77	3	0.06
Johnson Ranch	5/4/77	3	0.24

Station Name	Date	No. of Channels	Peak Accel. (g)
Harris Ranch	5/4/77	3	0.19
Grubbs Ranch	5/4/77	3	0.05
Nelson Ranch	5/4/77	3	0.03
Johnson Ranch	5/4/77*	3	0.58
Harris Ranch	5/4/77*	3	0.45
Grubbs Ranch	5/4/77*	3	0.06
Nelson Ranch	5/4/77*	3	0.03
Johnson Ranch	8/6/77	3	0.07
San Fernando	8/12/77	3	0.03
Newhall	8/12/77	3	0.06
Sherman Oaks	8/12/77	15	0.04
Vineyard Canyon	8/31/77	3	0.06
Newhall	9/24/77	3	0.05
Johnson Ranch	11/9/77	3	0.11
Harris Ranch	11/9/77	3	0.17
Vineyard Canyon	11/29/77	3	0.04
Long Valley Dam	12/7/77	9	0.05
Cholame # 5	12/28/77	3	0.05
Redwood Valley **	3/26/78	3	0.09
Talmage**	3/26/78	3	0.08
Sage	6/5/78	3	0.04
Puerta LaCruz	6/5/78	3	0.28
Palm Desert-Kiewit	6/5/78	9	0.03
Johnson Ranch	7/10/78	3	0.35
Harris Ranch	7/10/78	3	0.05
Vineyard Canyon	7/23/78	3	0.03
Tennant**	8/13/78	3	0.03
Goleta	8/13/78	3	0.39
Gibraltar Dam	8/13/78	9	0.09
Juncal Dam A	8/13/78	12	0.08
Juncal Dam B	8/13/78	6	0.08
Freitas Bldg.	8/13/78	9	0.67
North Hall, UCSB	8/13/78	9	0.99
Ventura Holiday Inn	8/13/78	15	0.06

Records from Unknown Events

Lockwood Valley	7/17/75	3	0.05
Vineyard Canyon	8/16/76	3	0.08
Palm Desert, Kiewit	11/15/76	9	0.03
Johnson Ranch	11/17/76	3	0.06
El Cerrito, Capwells	1/11/77	6	0.04
So. S.F., Kaiser	3/17/77	11	0.04
Kagel Canyon	4/17/78	3	0.02
North Hall, UCSB	6/27/78	9	0.04
Palm Springs, Hosp.	7/11/78	9	0.04
Santa Cruz	8/24/78	3	0.04
Meyers	9/5/78	3	0.06

* Multiple events, same day
** Temporary stations

[redacted]

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